VOL. 1 No. 2 June 1984

COMPUTER DIGEST

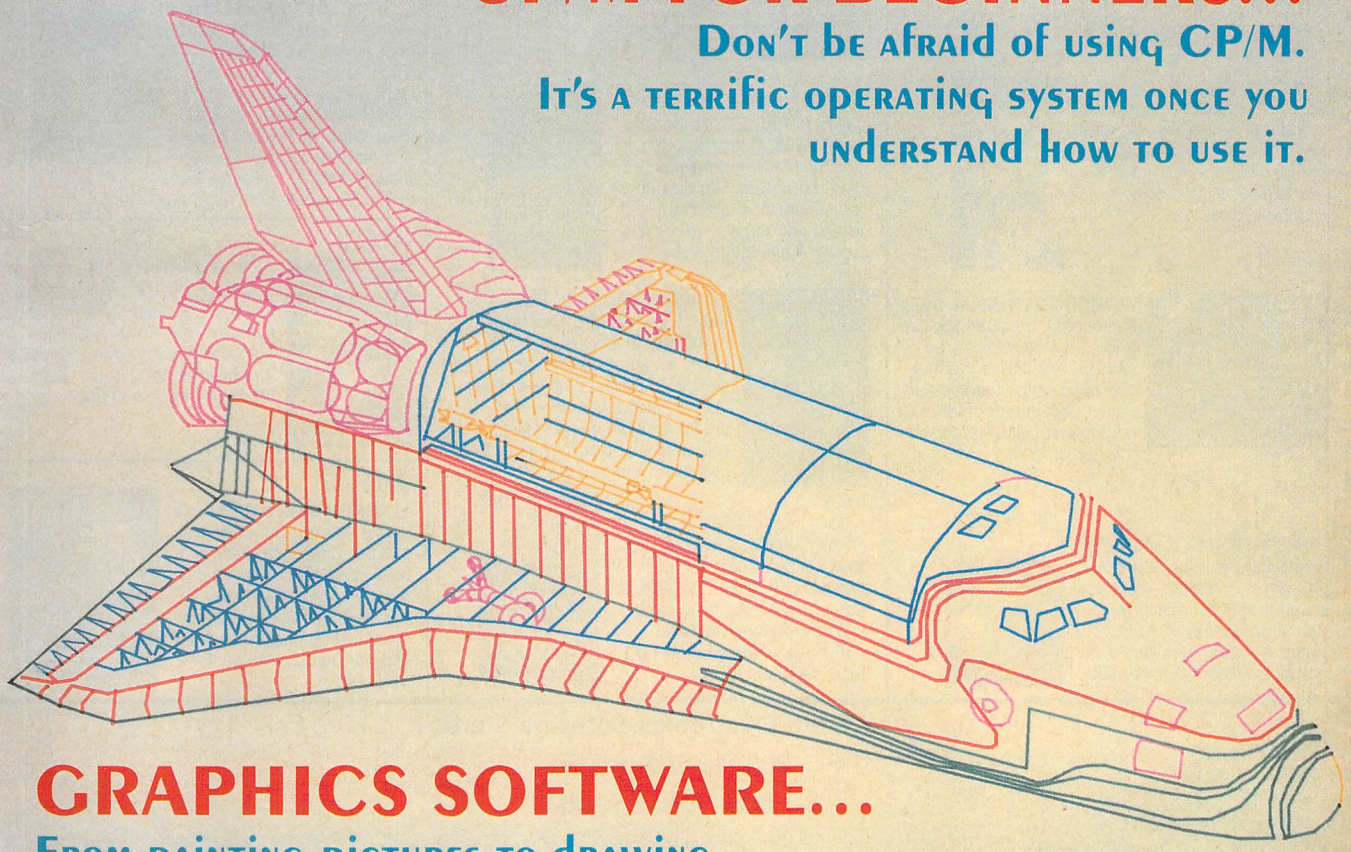
NEW KIND OF MAGAZINE FOR ELECTRONICS PROFESSIONALS

PC JR VS NEW TRANSPORTABLE...

A brand new IBM computer that you can carry with you wherever you go. Here's a comparison between the new transportable and the PC Jr.

CP/M FOR BEGINNERS...

Don't be afraid of using CP/M. It's a terrific operating system once you understand how to use it.



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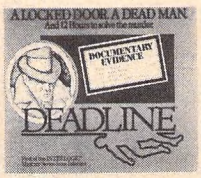

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COMING NEXT MONTH

First there was the *ZX80*, the machine that set the computer industry on its ear. Now Clive Sinclair is at it again with his latest entry, the *QL*. Find out how it stacks up against the competition in next month's issue.

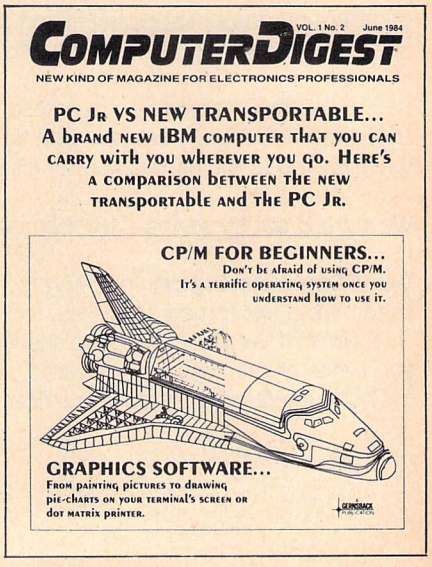
Computer telecommunications has received a lot of attention in the last year or so, but what exactly is it, and where does the average hobbyist fit in? Those are just some of the topics our look at telecommunications will cover.

Handling large amounts of data, or writing long reports or papers, is done much faster when done on a computer. Getting a printout of your work, however, is an entirely different matter. Losing use of your computer for minutes, or sometimes hours, while reams of paper are fed through even the fastest printers is unproductive, frustrating, and annoying. Next time, we'll find out all about how you can put an end to all of that by adding a printer buffer to your computer system.

ON THE COVER

Add a solid graphics software package to a computer and it becomes easy to prove the cliche "a picture is worth a thousand words." Learn all about some popular graphics software, and how they can make your computer "speak volumes," beginning on page 14.

The illustration on our cover was created on a Heath/Zenith *Z100* computer using a graphics software package called *Autocad*.


COMPUTERDIGEST
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NEW KIND OF MAGAZINE FOR ELECTRONICS PROFESSIONALS
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EDITORIAL

CAVEAT EMPTOR!

Money is tight. Nobody had to tell you that. All you have to do is to open your wallet or look at the balance in your checkbook. The things you want are harder and harder to come by. So you have to decide which things are necessities and which are luxuries. But it goes beyond that. Your purchases have to be exact and correct. There is no room for mistakes.

That's why a magazine like **ComputerDigest** becomes increasingly important to you. Not only do you learn what new products are available to you, but you'll also learn how well they perform, and whether or not they will be precisely what you want and need for your own computer system. In a tight-money situation, there's no room to buy, try, and discard. Your purchase must work for you the way you want it to, or you've lost your money.

The other thing that happens in that sort of situation, is that a lot of manufacturers compete for the bucks you've got to spend. Now competition is good for everybody. It keeps prices within reason, provides innovative products, and the industry continues to move forward. Yes, that's all to the good. Unfortunately, not all of the manufacturers can hold out in a highly-competitive market, and there's always a dropping by the wayside. If you buy a product and that manufacturer fails, you might wind up with a totally worthless guarantee.

What does it all mean? You've simply *got* to be a careful consumer! Before you make any purchase, you must be certain that you want and need the product that you're contemplating. Having made the decision to buy, you've got to use a careful process of elimination to select the manufacturer you want to deal with, and then pick that specific product of that specific manufacturer. When you've nailed down the manufacturer and model number, you go out shopping for price, and we hope, you'll deal with a local distributor who has an untainted reputation in addition to fair prices.

When you finally *do* make a purchase, we recommend that you stop shopping. Too many people waste time after a purchase, trying to verify that they made the right buy, after it's too late!

We started out by saying *Caveat Emptor*. It's Latin for "Let the Buyer Beware."

We at **ComputerDigest** are trying to help. We're working your side of the street. We'd like to hear from you, too. Got any specific problems or questions? If we don't have the answers, we'll know where to get them; and while all mail will be answered, we'll publish the letters that we think are most interesting. So do let us hear from you.

And hey... THANKS!

BYRON G. WELS
EDITOR

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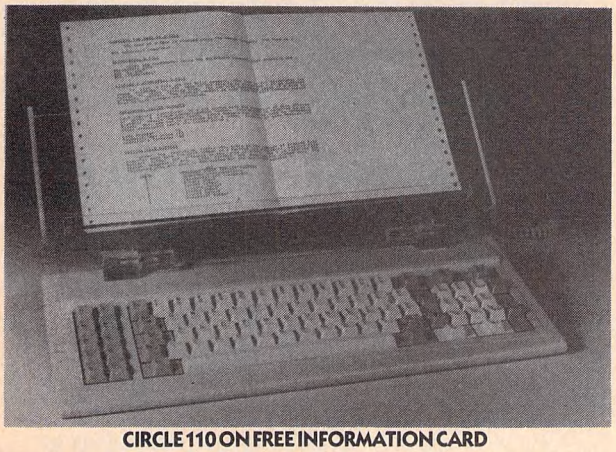
COMPUTER PRODUCTS

For more details use the free information card inside the back cover

DUSTCOVER, the *Copy Cover,* is a combination dust-cover and copy holder. Manufacturd from clear lucite, when down, it protects keyboards from dust and dirt; when it is flipped up (see photo) it becomes a copyholder that accommodates documents and computer printouts that measure up to 11 × 16 inches.

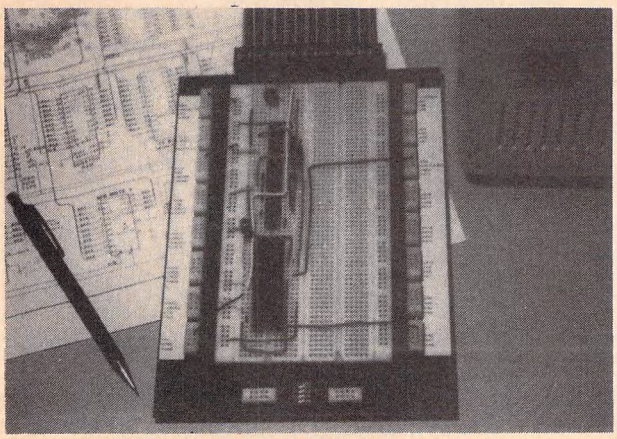


CIRCLE 110 ON FREE INFORMATION CARD

The *Copy Cover* clips on and off in seconds. Each unit is custom-fit and versions are available for most popular computer models, including IBM *PC, XT, jr*—Apple—Radio Shack's *Color Computer*—TI *99*—Commodore *64,* VIC-*20,* DEC Rainbow *100*—Columbia—Kaypro, and many other models. There is also a special verison available for the portable Radio Shack model *100* and the NEC *8201.* During the special introductory offer period, the *Copy Cover* is priced at $39.95.—**C-Thru Products,** 6351 Lk. Worth Road., Lk. Worth, FL 33463, Suite 111.

SOLDERLESS EXPERIMENTER SYSTEM, the *eZ Board,* provides a method for building experimental add-ons to interface with personal computers.

Features of the system include a glass expoxy circuit board mounted with a set of solderless breadboarding units for building circuits; four separate distribution buses with 50 tie-in points, each of which can be used for power, ground, clock lines, reset, and more.



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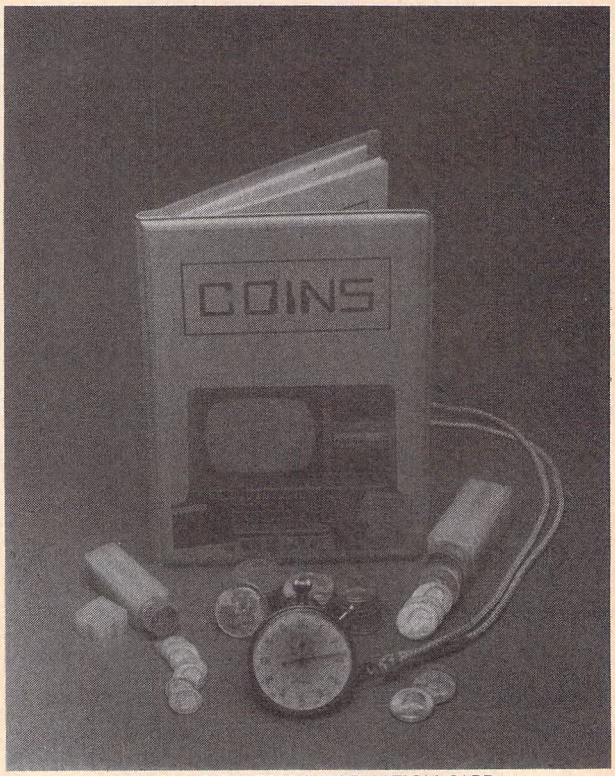
There is an array of tie-point blocks from which each pin of the computer's bus system (I/O channel) is clearly labelled and is easily accessible. A four-position DIP switch is mounted on the board. Each switch position connects to a set of tie-block sockets on either side, to aid in the development and analysis of experimental circuits. A flat ribbon cable connects the board to the computer's bus expansion slot.

Versions are available for IBM, Apple, and Commodore machines, as well as for hardware compatible models. The entire system, including cable and connectors, is priced at $174.95 each, plus $5.00 for shipping.—**Sabadia Export Corporation,** 3920 E. Coronado Street, Suite 206, Anaheim, CA 92807.

COIN-EVALUATION PROGRAM, *Coins,* automatically evaluates 1600 common American coins. Non-standard coins can also be listed and maintained, so that numismatists can determine the current market value of their collections. The package provides for special reports that show yearly purchases and sales, as well as a complete inventory.



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Optional quarterly update diskettes that will be available re-price the collection per current market values. IBM *PC/XT/jr,* Apple *II/II+/IIe,* and TRS-80 models *I/III* versions, including a 44-page manual and program diskette with latest value file are available at $95.00. (Previews Packs—manual only—are available for $10.) Add $2.50 for shipping and handling. MC/VISA order are acceptable; California residents are asked to please add 6% sales tax.—**Compu-Quote,** 6914 Berquist Avenue, Canoga Park, CA 91307.

IBM PCjr VERSUS THE PORTABLE

MARC STERN

Here we'll look at IBM's Portable PC and the PCjr to see if there are any similarities.

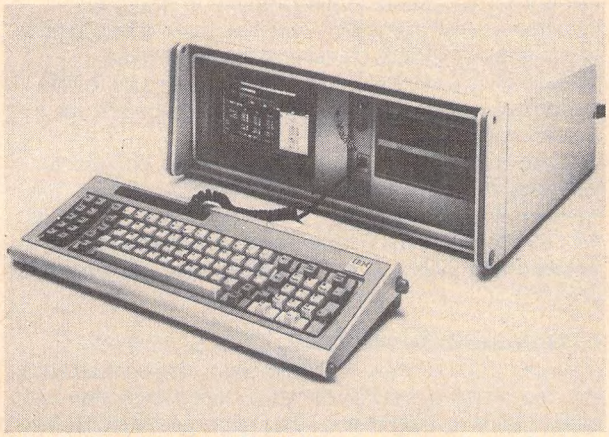


FIG. 1—THE NEW IBM PORTABLE personal computer features 256K of user memory and a single disk drive.

FIG. 2—THE IBM *PCjr*. The version shown here features a single disk drive, two cartridge slots, and a cordless keyboard.

■When IBM made its decision to enter the microcomputer market in 1981 with its Personal Computer (PC), it was generally considered a way of getting its foot in the door. The giant computer maker was dipping its toe—so to speak—into the waters of this market to see if it was right for the corporation.

The fact that this entry was rather cautious was hardly surprising because this area of the computer market was a giant unknown for IBM. Look at the original offering and you'll see what we mean.

It used an 8088 microprocessor—a proven device—which had a 16-bit internal architecture, but an 8-bit data bus. The computer used 16K static RAM IC's to provide a total of 64K of RAM on the motherboard; a cassette recorder interface, and a detachable 83-key keyboard. That combination is hardly what one would call revolutionary.

To upgrade this system, you had to buy special-purpose accessory boards that plugged into the motherboard (system board of the computer) and you had to buy a separate display device to see the system's output and that device needed a special plug-in card so it would work, too.

This, again, was hardly a new trend in the microcomputer world. Apple had been doing it successfully for four years before IBM jumped into it.

Like Apple, though, IBM used a cagey marketing strategy, one which was totally out of character with the company's traditional policy of in-house development, it made its system and bus architecture public, publishing a detailed "Technical Reference Manual." This manual allowed developers of non-IBM-developed accessory boards, peripherals and software to have a look at the memory and input/output (I/O) structure of the system and to develop products for it. IBM even went so far as making most of its Basic Input/Output System (BIOS) software public, with the exception of some proprietary Read-Only Memory (ROM) calls, so that anything developed for the IBM PC was compatible not only with the basic system, but other accessory devices and with IBM-developed products.

For IBM it was quite a daring maneuver, on the face of it. But, think about it for a moment. With its original minimal PC, it had very little at stake. If the market for the IBM PC failed to develop, the company was out the development costs of the basic system and for some tooling. Since the corporation relied so heavily on outside vendors, though, much of the development cost would be borne by third parties and they would be the ones who would have had to absorb any failure.

However, as we all know, the IBM-PC hardly failed at all. Almost at once, the market for this system began to skyrocket—even with the minimal level of hardware and software that was originally out there—and soon the IBM-PC became an industry standard. Almost immediately, a widespread network of hardware and software suppliers jumped on the bandwagon, providing IBM users with a wide array of accessory devices and software. Even IBM joined its own bandwagon by providing more and more IBM-packaged material for the PC.

Yet, IBM remained cautious, even though its market share in the microcomputer world soon approached and surpassed 20 percent. Some said this was due to IBM's fear of an anti-trust action if it came to dominate too much of the market. However, it is probably truer to say that it was a result of IBM's native business conservatism. It wanted to be sure the PC phenomenon was more than just a flash in the pan. And, while it took more than a-year-and-a-half for it to be convinced of

the success of the PC, the corporation eventually began turning out upgrades and additions to the PC line.

First came the PC-XT, an upgraded IBM Personal Computer that used 64K RAM IC's to provide a maximum of 256K on the motherboard and a 10-megabyte hard disk. Then came other upgrades to this system, the PC-XT/3270, IX and more. Each of these systems had more power and functionality. Some could be tied into a network of terminals, while others could support the UNIX operating system.

Eventually, as it had done in the mainframe computer world, IBM offered a full lineup of business-oriented systems, ranging from the basic PC—now called the PC1—to the full-blown PC-XT/IX. It is now even beginning to offer a small computer system for the scientific and engineering world, based on its S-9000 MC-68000 microcomputer, called the S2.

However, if you look at all of the additions to the line, you will see there were still two crucial areas in which IBM had no entries, the home computer and portable computer realms. The first of these gaps was filled in November, 1983 with the introduction of the IBM PCjr shown in Fig. 1. (see March **Radio Electronics** for a description of PCjr). The second obvious gap was filled in February, 1984 with the introduction of the IBM Portable Personal Computer (see Fig. 2). This now makes IBM competitive in all areas of the microcomputer market, with the exception of the lap or kneetop computer area and it is more than likely that this gap will be filled before long.

Compatibility Across Board

Perhaps one of IBM's shrewdest moves with all of its entries in the small computer world is the use of a common microprocessor and system architecture across the line. This assures compatibility from the low end to the high end and it further means that users will be able to migrate from one system to a higher-powered system as their needs change.

More important for the user, though, is the fact that the software base won't become obsolete simply by changing to a different IBM computer. Because the system architecture and disk format is the same, a program that runs on the PCjr will run on the PC and will run on the PC-XT and so on, provided, of course, that you use DOS 2.1.

This type of compatibility solves one of the long-time complaints in the microcomputer world—incompatibility of operating environments.

Since IBM has become so powerful in the microcomputer world, there are now many PC-compatible systems on the market that will emulate the IBM product and can use some of the same software. Some of them are so compatible that they will act the same as a PC and will run even IBM's proprietary software. This means compatibility across a great number of machines. However, there are varying levels of compatibility and you do have to check to find out just how compatible an IBM-compatible computer is.

For IBM, though, the compatibility between its systems means it can keep users "in-house" as they upgrade in their microcomputer needs.

With all of this background set out, let's take a detailed look at the Portable PC and PCjr.

Portable PC

Like all the IBM Personal Computers, the Portable PC uses an Intel-designed 8088 microprocessor that runs at 4.7 MHz. This microprocessor has a 16-bit internal architecture—16 registers for storage and data and it handles data internally in 16-bit chunks—two 8-bit digital words at a time.

However, to get its data from the rest of the system, it must make two 8-bit data fetches. The reason is the 8088 microprocessor only has an 8-bit data path (bus). This means that before it can take any action on a digital instruction, it must send for 8 bits of data, store them temporarily, and then ask for the remaining 8 bits of the instruction. This does slow response time somewhat.

The *PCjr*'sentry level model is packaged with software that's especially designed for users with little or no computer experience.

Included with the Portable PC, is a standard 256K of user memory (RAM). This means this portable will be able to run even the most memory-hungry programs. (Many 16-bit programs written now rely on a minimum system configuration of 128K of RAM and some even require 256K. The reasoning behind them is that memory is cheap and it is far better for program response to load the entire program in RAM, rather than relying on constant disk access every time something new is needed by the program.) This level of RAM is expandable to a maximum of 512K.

Interestingly, this is only half of the amount of RAM that a 16-bit microprocessor such as the 8088 can address. In reality, it can address up to megabyte of RAM. However, because of system constraints, at the moment, this is limited to 640K on the PC.

The Portable PC weighs about 30 pounds and folds

FOR A WIDE VARIETY of home and classroom applications, the *PCjr* can be used with the IBM *Compact Printer*. For instance, when used with the appropriate software, that combination can be used by students to produce reports, essays, etc.

WHEN USING IBM's Personal Computer Disk Operating System 2.1, the *PCjr's* enhanced model is compatible with a wide variety of business and personal-productivity programs are available for other IBM computers.

into a 20 × 17 × 8-inch package. It features the same type of 83-key, firm-touch keyboard that is used by the larger members of the IBM Personal Computer family.

Unlike the other members of the PC family, this system comes with a built-in 9-inch, high-resolution amber monitor that is capable of displaying graphics. It is capable of displaying the industry standard 80-columns by 25-lines and this makes this system ideal for professional use.

This system also offers a standard color-graphics monitor adapter card so this system can be used for color graphics work and is compatible with the latest version of the IBM disk operating system—2.1.

Since it is compatible with DOS 2.1, it indicates this system comes equipped with a disk drive—you don't need DOS if you don't have a disk drive—and it does. The standard disk drive is a slimline (half-height) double-sided, double-density unit that is capable of 360K of storage. A second drive is available as an option.

There are also five expansion slots on the motherboard, which, again, shows the heritage of the Portable PC—an open system architecture that you can fill in yourself. It does add to the initial $2,795 price for the one-drive system. An additional drive is $425, while a serial communications port is about $100, and a parallel printer port so you can use your Portable PC with a printer, is about another $150. The 256K memory addition option costs anywhere between $400 and $900, depending on where you get the 64K 250 ns RAM IC's required.

It also boosts the cost of this system to about what you'd expect to pay retail for a similarly equipped two-drive IBM-PC1 desktop model. However, you do get the advantage of portability.

Portable versus PCjr

As we noted earlier, the portable plugs one of the holes in IBM's small computer lineup, while PCjr plugs the other hole at the low end of the line.

Like the Portable, PCjr uses an 8088 microprocessor and, like the Portable, that processor runs at 4.7 MHz. However, it's there that the similarities stop and the contrasts begin.

Perhaps the first and biggest contrast is the price of the respective units. Where the Portable costs nearly $3,000, the PCjr is available in its base form for $669. This system includes 64K of RAM; a connector with a built-in RF modulator for a television set; a detachable keyboard; a connector for a cassette player so you can store data and load programs from tape, and Cartridge BASIC.

A more fully configured version—$1,889—includes the basic PCjr and 128K of RAM—the maximum allowed, versus the 512K possible with the Portable; the keyboard and a 360K slimline drive; the TV connector; the disk operating system; VisiCalc; Cartridge BASIC, and a word-processing program.

A fully configured system—$3,252—adds a high-resolution color display; connector for the display; internal modem; parallel printer adapter; graphics printer; Cartridge BASIC; the disk operating system, and a spreadsheet program.

As you can see, both systems are comparable in price when fully configured and both have about the same capability at that level. However, the Portable is a much more expensive machine in its basic form than the $1,889 PCjr and the Portable weighs much more, 30 pounds versus 11 pounds. However, it must be remembered that the Portable has much more metal in its construction than the nearly all-plastic PCjr.

Junior also has some standard features that are extra-cost options on the Portable or any other PC in the IBM product line. For instance, it features the built-in video adapter; a serial port, and a joystick adapter. It also features ROM software cartridge slots, another feature the larger PC lacks.

Where PCjr differs markedly is in its keyboard; system architecture and audio.

For starters, rather than employing the much more expensive, full-travel 83-key PC keyboard, Junior sports a 62-key cordless keyboard. It does support all of the same key functions as the bigger keyboard, but relies on dual-function keys to achieve them. Further, it lacks

any functions keys and has no numeric keypad.

The lightweight keyboard should be a long-lived, fairly indestructible unit because of its construction. When you look at it, the first thing you notice are the calculator-type keys IBM used. The rationale for this is that since this is primarily aimed at the home market and everyone in the family will be using it, it doesn't have to have a full, professional-style keyboard.

Underneath those keys is a rubber liner, that not only protects the inner workings of the keyboard from spills and other household disasters, but also provides them with the ability to return after being pushed. Each key has a corresponding dome impressed on the rubber liner and beneath this dome is a little circle of carbon that presses a contact and completes the key signal.

That signal travels through the keyboard's circuits to an infrared emitter/transmitter, the other highlight of this keyboard. It is this transmitter that links the keyboard with the system unit. The system box contains an infrared detection circuit that reads the keyboard codes sent to it and they are translated into the proper system codes so they can be displayed on the display tube.

IBM says this keyboard can be used up to 20 feet away from the system box, but provides an optional cable (at extra cost) to tie the keyboard to the system box, should there be other infrared-emitting devices in the area. If there are, it is possible the keyboard codes will be scrambled. PCjr is the first home computer on the market to use this technology.

Another important area of difference between the keyboards of the Portable and the PCjr is direct memory access (DMA). The Portable has it, while Junior doesn't. Because there is no direct memory access from the keyboard, the microprocessor must stop whatever it is doing whenever it needs more data or when it must write data to a disk or tape. This means there can be no keyboard input when Junior is handling a read or write-to-disk operation because the micro is totally absorbed with that operation. The keyboard is disabled, in fact, during information transfers.

This contrasts markedly with the Portable which uses DMA. This means you can continue to use the keyboard when a disk drive is accessed and you will not lose any keystrokes because they remain resident in the keyboard's memory-buffer area in RAM. It also means the processor can run at full speed in all actions because it doesn't have to devote its full attention to just one task.

System-Level Differences

There are also key differences at the system level that make the Portable and Junior stand apart. For starters, Junior can't use an 8087 co-processor chip for number crunching, as the Portable can. This immediately eliminates some software from the PCjr's repertoire.

Another difference is the level of RAM expandability. Where the Portable can be expanded up to 512K, Junior can only be expanded to 128K. This immediately limits the number of programs that can be used on the program. (To better illustrate this, let's say you have a PCjr with 128K of RAM. This RAM must set apart 16K for the video memory—the color display requires this—and 24K for the operating system—we're assuming a disk drive is being used. This means you've used up 40K of RAM before you load your program. Now, assume you load a 64K program into memory. This leaves only 24K of user memory for actual work, which isn't much. So, you are limited in the range of programs you can use.)

Another key difference is the amount of Read-Only Memory (ROM) and what the system does with it. In Junior, there is 64K of ROM. This is taken up by a minimal level of BASIC called Cassette BASIC, the BIOS and built-in diagnostics. In the Portable, the BIOS takes up 8K of ROM and the same level of BASIC takes up about another 32K of ROM. That's all there is. In Junior, the other 24K is taken up by disk operating routines that are handled from a program disk by the Portable.

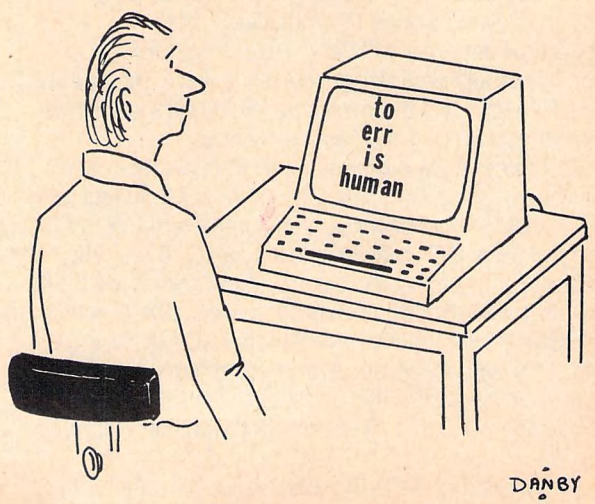
Finally, the PCjr is capable of generating a three-voice sound, compared with the single-channel sound capability of the rest of the PC line. This is thanks to the Texas Instruments large-scale integration audio function IC that is used in Junior.

Compatibility

Since it uses the same disk format—the way a disk is set up to handle data—and the same disk size, it is theoretically possible to use any IBM-compatible program with Junior. However, as we noted earlier, its memory limits dictate which ones can be used. Further, since there is only one disk drive available, it must act in place of two drives with some programs and that can also rule it out, unless you can reconfigure the program to work with one drive.

Yet, it should be possible to use many programs with Junior, provided they meet these criteria.

Overall, the IBM Portable PC and Junior are about as different as day is from night. The Portable is aimed at the more serious professional user or student, while the Junior is aimed at the home environment. However, in their own ways each system is as powerful as the other and, since they are nearly totally compatible, you can easily move from one to the other, allowing for easy migration as your needs change. Both systems should do well in their markets. ◀CD▶



CP/M FOR BEGINNERS

PART 2

HERB FRIEDMAN

Even if you learn nothing else about CP/M, you should learn how to use the PIP and STAT utilities.

NOTE

To avoid computer commands and statements which confuse the user, punctuation will be shown outside the quotation marks even when convention calls for them to be inside the marks. Also, capitalized words within the "<" and ">" symbols mean a specific key; ie., <ENTER> is the key marked ENTER or RETURN (carriage return), while <CONTROL>- means the key or keys on your computer which function as a single CONTROL key. While CP/M commands can be either in upper or lower case or a combination of case, for uniformity they will be shown in upper case only. For example, the command LOAD- = load = LoAd = LoaD, etc.

■The point is open to debate, but for the applications-oriented user of the modern personal computer, the very keystone of CP/M is a utility program supplied with CP/M called PIP—an acronym for *P*eripheral *I*nterchange *P*rogram.

In plain terms, PIP is the equivalent of the function "COPY TO". When we say PIP a program, we are in effect saying that we have loaded a program into the computer's memory that permits us to copy a program, data, or just a single character from one piece of hardware to another.

PIP came about because the kind of computer for which CP/M was originally intended could accommodate many different user-selectable I/O (input/output) devices generically called "peripherals", and PIP provided the means whereby data could be exchanged among the various devices.

To digress for a moment, keep in mind that each peripheral accommodated by CP/M is identified for I/O by a "colon". For example, the control terminal is CON:, the printer is LST:, the disk drives are A:, B:, C:, etc. Except for one specific case, without the colon CP/M has no idea what device is to be used. (We'll get to the exception later.) Many newcomers to CP/M have difficulty with CP/M because they forget about the colon, or inadvertently substitute ";" or "*" because of the keyboard layout. Without the colon, PIP will not work.

PIP works this way. Let's assume for a moment that after years of effort you have written a program called FUTURE.COM which foretells the future. It is located on a disk in drive A:. You are ready to have the computer tell you what horses will win *tomorrow* at Hialeah, but you're afraid to run the program for fear it will crash and years of effort will be wiped out; so you want to make a backup copy in disk drive B:. You do it with PIP. The command line "PIP B:=A:FUTURE.COM" will cause the program PIP to load into the computer's memory, auto-run and copy to disk drive B: the FUTURE.COM program from drive A:, then return you to the CP/M command prompt "A>".

By now you should have guessed that under PIP the "=" character means "from". You should also recognize that copies have the same filename as the original, unless specifically changed. For example, the command "PIP B:MAKEMONI.COM=A:FUTURE.COM" will result in disk B: having the file MAKEMONI.COM, which is a mirror image of FUTURE.COM except for the filename.

At this point some of you old hands at CP/M are probably ready to take pen in hand to write in that there is no need to identify the control (default) disk drive, that the proper entry when A: is the control (default) drive is "PIP B:=FUTURE.COM" rather than "PIP B:I.COM=A:FUTURE.COM".

You are correct, of course. The control drive is the exception we mentioned earlier. If no device is specified CP/M assumes you mean the default drive, which is drive A:, or whatever you select as the control drive. Unfortunately, many newcomers to CP/M get

confused as to when to specify the control device. The fewest difficulties arise if the control drive is always entered where it would normally be assumed. It does no harm to enter the control drive.

Another example of PIP will serve to clarify its power and then we can move on. If we enter the command "PIP LST:=CON:" what we are saying is copy to the line printer (LST:) from the control console (CON:). What we type on the keyboard will go to the printer and will be printed on a sheet of paper. Logically, this "connection" will last to the end of time, so how do we free the printer from the keyboard? With a <CONTROL>-Z, PIP's command for "bail out". When PIP receives a <CONTROL>-Z it terminates a copy function.

Multiple file operations

When we use a single command line for PIP, such as "PIP B:=A:FUTURE.COM", we are returned to the CP/M command prompt (the "A>") when the copy is completed. However, if we have several disk files to transfer it's possible to "lock" the computer in the PIP mode and simply issue a series of "copy" commands.

To enter a "locked" PIP mode type "PIP <ENTER>". The screen will return the asterisk symbol ("*"), which we call a "star" when talking in *CPMese*. (*CPMese* being a foreign language slightly more difficult to understand than *Chinese*.) When the star is on the screen we can transfer data by simply typing the desired copy command, such as "B:=A:FUTURE.COM". When the copy is completed the star reappears on the screen and you can enter another direct copy command, such as "LST:=CON:" which causes the lineprinter to print whatever is entered on the keyboard. A <CONTROL>-Z returns control to PIP and the star appears.

When all the copies have been completed, a keyboard <CONTROL>-C terminates PIP and returns the computer to the CP/M command prompt ("A>"). The entire sequence for three file copies might appear on the screen as:

```
A> PIP <ENTER>
* B:=A:FUTURE.COM (ENTER>
* C:WORDSTAR.DOC=B:TEXTFILE.TXT <ENTER>
* LST:=CON: <ENTER>
Your typed text appears here and goes to the printer.
<<CONTROL>-Z>
* <CONTROL>-C <ENTER>
A>
```

Notice that while the <ENTER> key must be depressed to enter each copy command which is self-completing, a <CONTROL>-Z is required to terminate/complete the keyboard entry mode.

When you want all the user files on a disk PIP'd to another disk, you can avoid entering a command line for each file by using PIP's universal "copy everything" command called "STAR-DOT-STAR", meaning "*.*". The command "PIP B:=A:*.*" will result in every user file on disk B: being copied to disk A:.

Let's take a break and try to work out a few unusual applications of PIP. For a refresher, remember we said PIP will always assume the control drive. Figure this one out: "PIP LST:=FUTURE.DAT. If you said a disk text data file on the command drive will be copied on the printer you've got a decent grasp of PIP. (If FUTURE.DAT was a binary, rather than a text file, the print would consist of "garbage".)

Here's a more difficult one. "PIP B:DOCUMENT.TXT =CON:". This PIP command will produce a text disk file called DOCUMENT.TXT on drive B: as you type on the control console's keyboard. You would enter a <CONTROL>-Z to indicated the text is completed and you wanted to terminate PIP and return to the "A>" CP/M prompt (or whatever you're using for the command drive).

PIP options

PIP has a whole slew of options which are appended within *bracket* symbols to *the end* of the PIP command. (Remember, you must use brackets, "[and]", not parenthesis.) Some are useful for the average user, others are intended primarily for programmers and other computer science types. We shall cover only the most important applications-oriented options. First off, there is the V-option, which checks a destination disk file against the original. It takes somewhat longer for the PIPing to finish, but you can be certain you have a glitch-free copy. The V-option is entered thusly: "PIP B:=A:FUTURE.COM[V]".

CP/M has things called "hidden" files, which you don't normally see displayed when you call for a directory listing. To copy a hidden file you must use the R-option, which you can simply tack on to any other option within the brackets. For example, a PIP command might be: "PIP C:=B:HIDENFIL.COM[VR], meaning, copy the hidden file B:HIDENFIL.COM on drive C: and also verify the the copy. Other useful options are listed in your CP/M manual, but one of the most useful, the G-option, is often not understood by newcomers to CP/M.

The G-option means "get"—get a file from a user area from 1 to 15. In the last installment of this article, we showed how user files are used to avoid directory clutter; that related disk files could be assigned with a software "tag" to specific user areas. It is the G-option that permits you to copy tagged disk files. For example, assume you have concealed your spreadsheet data in B: drive USER 5 under the filename MULTIPLN.DAT, but you now need to integrate some of its data into a report you're preparing with your word processor in drive A: USER Ø. This is where the G-option comes in.

If you enter the command "PIP A:=B:MULTPLN.DAT" CP/M will have no idea what you're talking about because all drives operate in the same user area as the control drive, and there is no spreadsheet datafile in the USER Ø area of drive B: But if your command is "PIP A:=B:MULTIPLN.DAT[G5] you will copy the datafile to A: because "[G5] tells PIP to get the disk file from USER 5. Sneaky, no? Problem is, the author of CP/M did not include a function that works the other way. You cannot use PIP to move a disk file *to* another user area. For example, assume you have your crystal ball program FUTURE.COM on disk A: USER Ø, the default user area, and you want to conceal it from general view in USER 8. It can't be done with a straight PIP command because, except for special versions of PIP used for hard disk computers, PIP will not copy to a user area. If you enter the USER 8 area you still can't copy because

PIP does not exist in USER 8. This is called ,...being caught between a rock, a hard place, and a somewhat sloppy disk operating system.".

What you must do is create a copy of PIP in USER 8. (If you say the disk will now have two PIP programs, one tagged USER Ø and the other USER 8 you have a solid grasp of CP/M.) Creating a copy of PIP in USER 8 is a simple enough procedure that you don't have to understand. It's like using a housekey. The key opens the lock but you don't have to understand how the lock works to be able to get into your home.

It can be done this way. Place the disk with the program FUTURE.COM and PIP in drive A:. Place a disk with the CP/M utility DDT.COM in drive B:. In response to the A> CP/M prompt enter "B:DDT PIP.COM", which tells the computer to load DDT from drive B: and process PIP from drive A:.

The screen will show:

DDT VERS 2.2
NEXT PC
xxxx xxxx (xxxx is a Hex number)
-

The "-" is your prompt. Type "GØ" <ENTER>. Then type "USER 8" <ENTER>. Then type "SAVE 29 PIP.COM" <ENTER>. The entire sequence will appear on the screen as:

A>B:DDT PIP.COM
DDT VERS 2.2
Next PC
xxxx xxxx
-GØ
A>USER 8
A>SAVE 29 PIP.COM.

If you have any problem running PIP in USER 8 substitute the command "SAVE 3Ø PIP.COM". You will be left in USER 8. A DIR command will show PIP.COM in the directory, which you can now use to move FUTURE.COM from USER Ø. But remember, you will need the "get" tag for PIP. To copy the program you will use the command "PIP A:=A:FUTURE.COM[GØ]. (If you can understand this the first time around you are going to be a whiz at CP/M.) To help those of you having some difficulty understanding what is being done, the command line means: "Copy to the USER 8 area of A: the program FUTURE.COM from the USER Ø area of the same disk (A:)".

Your disk will now contain two copies of PIP.COM and two of FUTURE.COM. You can erase PIP.COM from USER 8 and FUTURE.COM from USER Ø.

If you plan on extensive use of the user areas, life will be much easier in general if you prepare a sysgened (system) disk having PIP.COM utility in all the planned user areas, perhaps Ø through 6, or 8. In this way, if you're in a user area and you want to copy or move a program you can pop your "PIP" disk into drive B: or C:, or whatever, and instantly use PIP from any user area without having to go through the DDT routine each time. In my own case I have a disk with PIP, STAT, and XDIR (a public domain extended directory) in each user area.

The STAT command

The CP/M utility "STAT" serves two proposes. In the first instance it means "statistics", and will provide information on individual files or the disk itself. It tells you how many records are used for each disk file, the file size (in increments of 2K), how how much storage is available on the entire disk itself, and how much is left. The problem with STAT is it provides information on only one file or drive at a time. On the other hand, a a public domain program called XDIR (get a copy from a friend) serves as both a directory and universal STAT command, simultaneously providing statistics on all the files and the entire disk itself.

Figures 1, 2 and 3 illustrates the difference. Figure 1 is a standard directory listing of a disk. Figure 2 is the

```
A>DIR
A: POWER    COM : CONFIG   COM : DISK76C  COM : DISK74B  COM
A: D        COM : PIPKAY   COM : FORMAT   COM : INTERCHG COM
A: MEMLINK  COM : MODEM    COM : PIP      COM : STAT     COM
A: SUBMIT   COM : SYSGEN   COM : XSUB     COM : XDIR     COM
```

FIG. 1—A STANDARD CP/M DIRECTORY listing will produce a display similar to this one.

```
A>STAT POWER.COM

 Recs  Bytes  Ext Acc
  116    16k    1 R/W A:POWER.COM
Bytes Remaining On A: 76k
```

FIG. 2—THE STAT COMMAND of a file listed in the directory displays the statistics of the particular program and the available disk storage space.

display when a STAT is taken on the POWER.COM file. Note the display shows how many bytes remain on the disk. Figure 3 is the display using XDIR (extended directory); it presents a directory, all the important statistics on each user file, and a lot of meaningful statistics on the disk itself.

```
A>XDIR
Extended Directory version 3.5

CONFIG  .COM  10k
D       .COM   4k
DISK74B .COM   4k
DISK76C .COM   4k
FORMAT  .COM   6k
INTERCHG.COM   4k
MEMLINK .COM   2k
MODEM   .COM   8k
PIP     .COM   8k
PIPKAY  .COM   8k
POWER   .COM  16k
STAT    .COM   6k
SUBMIT  .COM   2k
SYSGEN  .COM   2k
XDIR    .COM   4k
XSUB    .COM   2k

Disk A:  2k blocks
Size=  170K, 16 Files, Used=   94K, Space=   76K
```

FIG. 3—XDIR, a public domain CP/M utility combines the DIR and STAT commands and produces an alphabetized listing that also contains the file and disk statistics.

You found an error! The files only add up to 90K but the disk statistics shows 94K used! The "missing" 4K are the invisible system files, the ones not listed by the directory.

Figure 4 is an unusual kind of extended directory: the "STAT'd" screen display produced by the D.COM file used by Kaypro. It also shows the length of each file and the disk statistics, but notice it subtracts the system files from the total disk capacity. It displays the available capacity as 166K rather than 170K. The numbers are slightly different but the end result is the same.

STAT also works as an "assign" function. Among other things STAT can assign a file or a disk to be read only, or read/write. For many newcomers to CP/M, the most intriguing function is STAT's ability to assign different peripherals as I/O devices.

As we mentioned earlier, CP/M was intended to work with many peripherals. In actual fact, CP/M recognizes only the disk drives and four "logical" devices: LST: (list device for output, i.e., a printer); PUN: (punch device for data input); RDR: (reader for data input); and CON: (control terminal). In order to get the data in and out of the desired peripherals, which are called "physical" devices, the peripheral itself must be assigned to function as one of the four recognized devices, what CP/M calls the "logical" device.

CP/M supports twelve physical devices, though the modern personal computer might support only four to eight of them. The physical devices include the CRT: (video display terminal), UC1: (user defined console), a TTY: (teletype terminal or printer), and assorted user-installed I/O devices such as PTR: (paper tape reader), PTP: (paper tape punch), UR1: (user defined tape reader), UP1: (user defined punch), UL1: (user defined list device).

Each manufacturer more or less decides for himself what physical devices will be allowed and whether they will be serial or parallel input, or both, or IEEE. Often, a manufacturer will assign several "physical" devices to the same I/O port. For example, TTY:, UR1:, UL1: and CRT: might all reference the same serial port. Regardless which you selected you would end up on the serial I/O. It is the STAT function that selects the logical-physical relationship. For example, one popular computer allows the user to select one of four physical devices as a logical device. They are:

CON: = TTY: CRT: BAT: UC1:
LST: = TTY: CRT: LPT: UL1:
RDR: = TTY: PTR: UR1: UR2:
PUN: = TTY: PTP: UP1: UP2:

What this chart shows are the four possible peripherals that can be assigned to each logical function. To keep things simple, the manufacturer will probably have CP/M recognize TTY: BAT: UC1: PTR: and UL1: as the serial RS-232C I/O, LPT:, the line printer, as either serial or parallel, and UP1 as parallel. Actually, he can allow whatever assignments he wants to permit. (The user will not have 12 individual I/O ports to worry about.)

Every desktop computer has default device assignments which can be changed by the user through the STAT command. For example, "STAT CON:=TTY:" will cause a connected teletypewriter to function as the control terminal, while a "STAT CON:=UC1:" will permit any terminal connected to the serial I/O to function as the control terminal because the manufacturer decided UC1: will represent the RS-232 port on his computers.

Similarly, "STAT LST:= LPT:" will use the parallel printer as the printer, while "STAT LST:=UP1: uses a serial printer connected to the serial port as the listing device.

For each computer, the "STAT VAL:" command results in a listing of all the possible device assignments for a particular computer, while "STAT DEV:" lists the current device assignments, as illustrated in Figs. 5 and 6.

While many of the PIP and STAT functions appear formidable the first few times you try to understand or use them—you actually can use them without understanding anything about them, their mystery tends to vanish when you spend an evening or so experimenting "hands on". You can't break anything if you make a mistake; all you can do is erase disk files, so just make certain you don't have your only copy of FUTURE.COM in the disk drive when you give PIP and STAT that "Old Hand's-On Try". ◀Ⓓ▶

```
A>D
Name    Ext Bytes   Name    Ext Bytes   Name    Ext Bytes   Name    Ext Bytes
CONFIG  COM   10K ! FORMAT  COM    6K ! PIP     COM    8K ! SUBMIT  COM    2K
D       COM    4K ! INTERCHGCOM    4K ! PIPKAY  COM    8K ! SYSGEN  COM    2K
DISK74B COM    4K ! MEMLINK COM    2K ! POWER   COM   16K ! XDIR    COM    4K
DISK76C COM    4K ! MODEM   COM    8K ! STAT    COM    6K ! XSUB    COM    2K
16 File(s), occupying 90K of 166K total capacity
112 directory entries and 76K bytes remain on A:
```

FIG. 4—KAYPRO'S D.COM combined DIR and STAT utility provides almost the same information as XDIR. The major difference being the way the disk statistics are presented.

```
A>STAT VAL:

Temp R/O Disk: d:=R/O
Set Indicator: d:filename.typ $R/O $R/W $SYS $DIR
Disk Status  : DSK: d:DSK:
User Status  : USR:
Iobyte Assign:
CON: = TTY: CRT: BAT: UC1:
RDR: = TTY: PTR: UR1: UR2:
PUN: = TTY: PTP: UP1: UP2:
LST: = TTY: CRT: LPT: UL1:
```

FIG. 5—AMONG OTHER TIDBITS of information about the disk, the command STAT VAL: shows the possible physical device assignments for CP/M's four logical devices. For example, the CON: (control terminal) cannot be assigned to LPT: (the printer), or whatever is considered UL1:. CON: can only be TTY:, CRT:, BAT:, or UC1:.

```
A>STAT DEV:
CON: is TTY:
RDR: is TTY:
PUN: is TTY:
LST: is LPT:
```

FIG. 6—THE STAT COMMAND displays the actual logical/physical assignments in use.

COMPUTER GRAPHICS

The best way to convey a lot of information quickly is through computer graphics.

HERB FRIEDMAN

■Among the most eye catching computer screen displays is anything having to do with *graphics*. Whether it's row after row of three-dimensional bars that look more like skyscraper buildings, multi-colored pies with a slice cut out, or just irregular lines that rise and fall as they interlace with other lines, graphic displays are unusual, attractive, and do catch our attention; so much so that personal computers and their software are often touted or sold on the basis of their graphics capabilities.

For example, ask your local computer store salespersons to demonstrate Lotus 1-2-3 and they will probably bring up some form of spreadsheet display, then exclaim "Watch this!" as they touch a few keys, and suddenly the screen transforms into a bar graph representation of the data. A most impressive demonstration because it proves the old cliche that "A picture is worth a thousand words."

Or maybe you're shopping for a printer. It's a safe bet that somewhere along the line the graphics capabilities of various dot-matrix printers will be prominently mentioned, and in most—if not all—instances the graphics will be discussed in terms of bar and pie charts, not computer art.

Unfortunately, what you see is often not what you get when it comes to graphics and the lesser-cost computer systems, those we call the home-and-family or small business systems. There are inherent limitations in both the computers and printers which restrict what, or how much data can be graphically displayed, or the manner in which it's displayed. Then again, there is also the cost of the software itself. Decent graphics—other than conventional bar charts—require some rather sophisticated programming, and even not-so-good graphics software doesn't come cheap. Depending on how much performance is being offered for the money, a low-cost software package can range from "not bad" to "downright rotten", with "not bad" the more common level of performance.

Bar charts

Take, for example, the bar charts mentioned earlier. Bar charts are relatively easy to program in BASIC, so even budget software can accommodate some form of automatic data-to-graphics conversion. The EASY FINANCE I software for the Commodore 64 computer is a good illustration of low-cost bar-charting. The program itself is primarily intended to resolve typical home-and-family financial situations, such as the

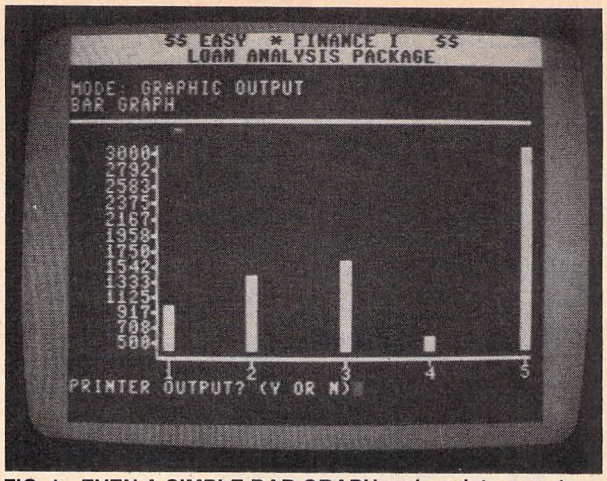


FIG. 1—EVEN A SIMPLE BAR GRAPH makes data easy to comprehend.

difference in monthly payments depending on the size and interest rate of a mortgage; the size of monthly payments on financed shop test equipment; the actual interest charged by the bank on a family or business loan; how much interest your money earns depending on the interest rate, frequency of compounding, etc. While all the information displayed on the screen can be printed, EASY FINANCE I will permit the user to convert charted data such as the screen display shown in Fig. 1 into bar graphs. Considering that the program sells for less than $20, that's a lot of performance for the price.

Most inexpensive computers such as the *Commodore 64* and the Radio Shack *Color Computer* support graphics. Unfortunately, the same cannot usually be done with a somewhat more expensive computer because, unless retrofitted with hardware, they usually will not support a meaningful graphics display. The typical CP/M computers, at best, support limited graphics: a bar this way, a line that way, a triangle, a rectangle—altogether, not enough for a precise or meaningful graphics-screen display. Oh, there will be something on the screen, but a meaningful display must be printed using a matrix printer.

Many programmers recognize the limitation of computers not having specific graphics capability and don't even try for a screen display, even for those computers having limited screen-graphics capability. Instead, the effort goes into providing notably good printer output from standard printers. The DATA PLOT software (Lark Software, 7 Cedars Rd., Caldwell, NJ 07006) is a good example of low-cost software giving noteworthy performance by limiting itself to doing a particular job well. DATA PLOT is specifically intended only for the printing of line, multi-line and scatter charts. To this end it will read data directly from values entered into disk file via a word processor, or directly from a spreadsheet or other datafile. After the titles, headings, etc. are prepared, all output shifts directly to the printer, where a chart is printed that is precisely the specified size (in inches), with the titles also precisely positioned because their positions are also specified in inches, rather than guestimated by the cursor position. For extreme title-positioning accuracy—the equal of

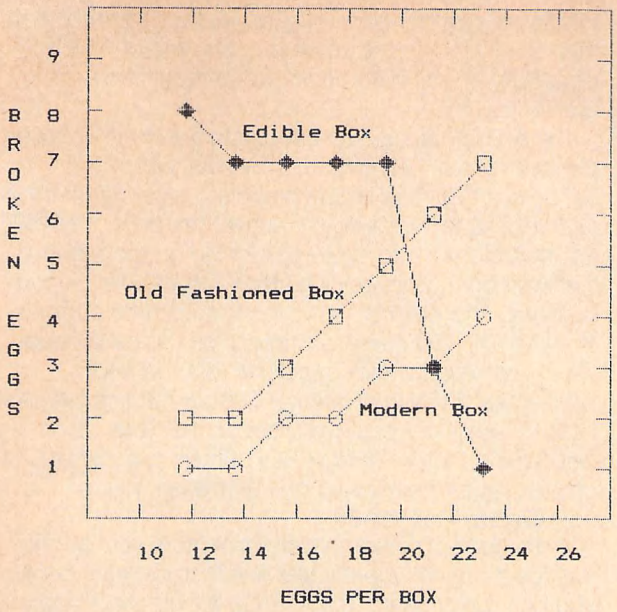


FIG. 2—OUTPUT FROM DATA PLOT shows how much you can convey with just a simple line chart.

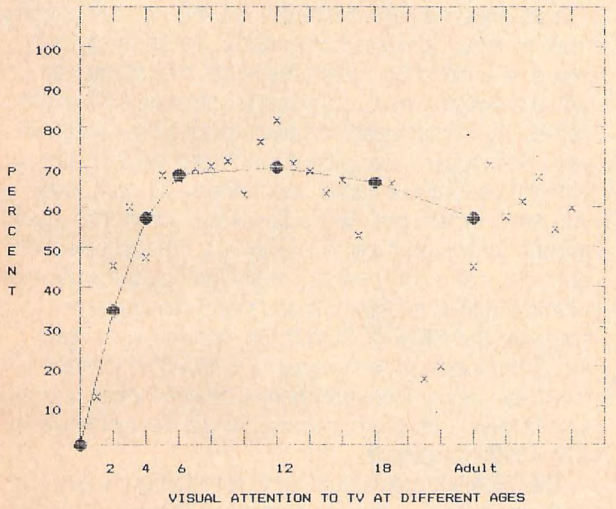


FIG. 3—A MIXED GRAPH of lines and unconnected points produced by DATA PLOT. It's almost impossible to convey the meaning of the data with just words.

typesetting—the user can make a print, measure dimensions on the print, and then go back to the program and specify precisely where the titles are to be located within a tenth of an inch.

Another extra feature of DATA PLOT is that the "points" for each line can have a different size, shape or shading, making it easy to follow which line goes where. This kind of detail is possible only on moderately expensive computers (such as the IBM) or through a printout when using a low-cost computer. Examples of the DATA PLOT output are shown in Figs. 2 and 3.

An unusual example of sophisticated graphics for budget computers is Radio Shack's "GRAPHIC PAK" for their *Color Computer.* GRAPHICS PAK provides line, bar and even pie charts. It can stack several charts on a single bar, group bars, create multi-color pie charts, and even create a pie chart with a displaced wedge.

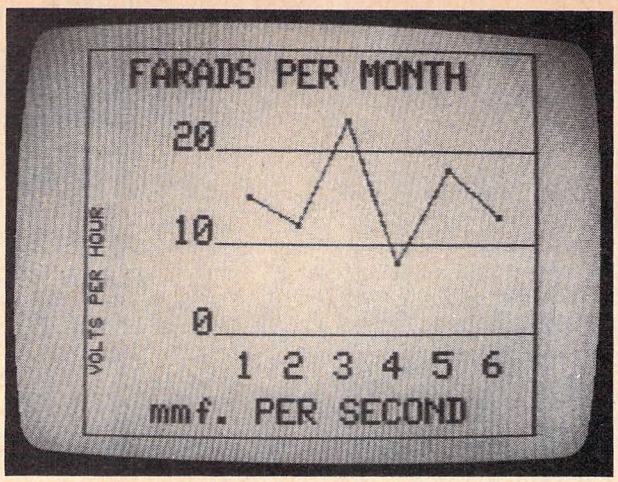


FIG. 4—TYPICAL OF GRAPHICS PAK, this Color Computer display can be edited and re-edited until the desired graph is obtained. GRAPHICS PAK is considered by many to be the best low-cost graphics instructional aid.

The screen displays can be in moderately high definition 2-color or low definition 4-color. While the graphics can be printed out, at the time this article was prepared it was possible using only two specific Radio Shack printers, one a monochrome (one color) matrix "line printer", the other a color "pen plotter" using a "print head" holding four (including black) colored pens. Unfortunately, the color printer utilizes a narrow width paper which must be pasted on a larger sheet if incorporated into reports.

Naturally, one doesn't expect gold-plated performance from a budget priced computer. While you can save the "charts" on cassette tape, each must be initially created by directly entering the data on the keyboard. GRAPHICS PAK does not read data files so it cannot automatically extract data from spreadsheets, word-processed tables, etc.

Storage and printer limitations aside, however, if you need a decent screen display for your own viewing, for photography, or for demonstration in a classroom, a showcase, or whatever, the GRAPHICS PAK /CoCo package does the job well. Figure 4 shows the kind of photo record you can get from GRAPHICS PAK using a low-cost Polaroid camera.

Graphics and CP/M

The same kind of multi-chart capability as GRAPHICS PAK—but with printing and automatic calculations—is available for CP/M computers through several programs, one of the best known being GRAFIKS 2.0. (Robonics, 936 Hermosa Ave., Hermosa Beach, CA 90254). GRAFIKS 2.0 creates multi-bar, line and pie charts. It will accept input directly from the keyboard or it will read data from files, such as a SuperCalc data file, and it even permits overlays of one chart on another. Typical of the better graphics software, GRAFIKS 2.0 will do automatic scaling. Even if you make an error in data entry, such as entering percentages that do not add up to the whole of a pie, GRAFIKS will attempt to correct the users "errors" by converting to percentages of a whole, providing decimal values if necessary. It will also solve algebraic equations and plot the results (such as a sinewave).

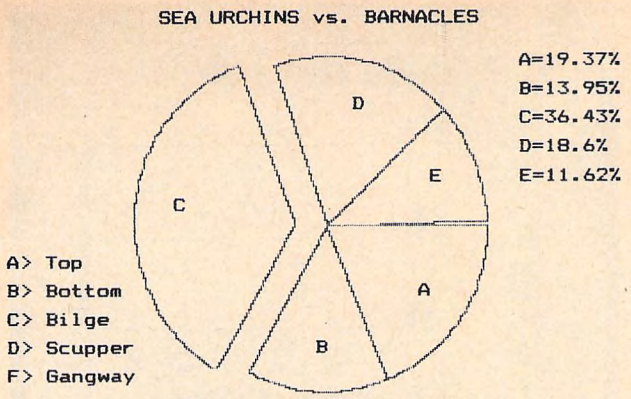


FIG. 5—PIE CHART FROM GRAFIKS. 2.0. The pie chart is produced by most graphics software.

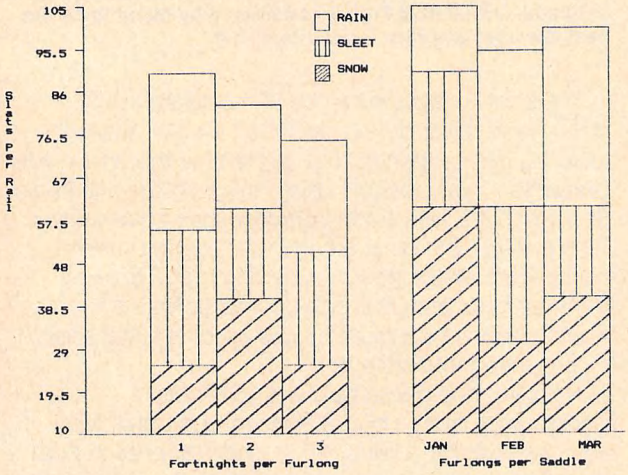


FIG. 6—BAR CHART FROM GRAFIKS 2.0. The keyed legends and automatic scaling of the bar chart is "heavyweight" performance.

Because of the graphics limitations of unenhanced CP/M, the GRAFIKS 2.0 screen display only serves as a reference for making rough evaluations of the graphics display and for the positioning of labels and titles. Unlike the precise title positioning of DATA PLOT, the GRAFIKS 2.0 labels are positioned on the screen with guestimates; final positioning can be corrected after the first print is made. Figures 5 and 6 show some of the flexibility of a full-featured graphics program such as GRAFIKS 2.0.

Because graphics printout is highly dependent on the printer being used, it's important that you are certain the software will work with your printer. As a general rule, graphics software will be available in several versions to accommodate the popular printers, or will be provided with several user-selected "drivers" for a broad selection of printers. Even then you must be careful. For example, much of the graphics software is intended for printout on an Epson *MX-80* printer or one of its clones. There are, however, at least three versions of the *MX-80*: the original model, the *Graftrax* model (which provides backspacing), and the *Graftrax-Plus* model (backspacing and a bagful of bells and whistles). As a general rule, a printer must backspace or it cannot create graphics with most of the lower priced software. Radio Shack, as mentioned earlier, is in a whole different ballpark with its graphics software and they are limited to their own printers, one of which does not use standard paper, for printouts from GRAPHICS PAK.

DATA PLOT can use several printers and either Epson *Graftrax* model. GRAFIKS 2.0, however, which will utilize both *Graftrax* Epson printers, works differently. A *Graftrax* model repositions (homes) the print head full left before each and every tick (mark) on the paper; the wear on the positioning motor for a single printout is severe, and one can actually sense that the motor is slowing. The *Graftrax-Plus* printers, on the other hand, allow the head to track directly across the paper, printing each tick in sequence without homing the print head. In addition to saving wear on the head positioning motor, *Graftrax-Plus* printers take minutes to create a graph that would take almost an hour on the non-*Graftrax-Plus MX-80*.

Admittedly, it's hard to determine how your printer will function with a particular graphics program before you buy the program. Since rarely, if ever, is software returnable if not originally defective, it's worth the extra effort to find out if the software will deliver optimum performance with your printer *before* you buy.

If you need a high definition graphics screen display from a home/business computer in addition to, or in place of, a printout, there's really not much you can do. While the Atari and Commodore computers have the capability for acceptable screen display the software selection doesn't exists (not much demand to start with). If you have a Radio Shack Model III computer you have lucked out. Radio Shack has a high definition retrofit, for which there is presently a limited selection of stand-alone software; it's really intended for use from within a BASIC program. If you need stand-alone software the GRAFYX SOLUTION retrofit (Micro-Labs, Inc. 902 Pinecrest, Richardsen, TX 75080) is probably what you need. That aftermarket device consists of a small board that plugs into the Model III: it provides a 512 x 192 dot display.

The GRAFYX can be utilized directly from a BASIC program (either commercial or user-written), or through pre-written software from Micro-Labs that is specifically written for use with GRAFYX. Among the Micro-Labs software is BIZGRAPH, which creates three dimensional bar graphs, and line and shaded-area charts and charts integrating both presentations, and pie charts.

We have touched briefly on some of the highlights of graphics software for the the lower cost computers. If there is one general rule we can apply to graphics software it's that the most important feature, the one you are actually spending the money for, probably isn't in the package you're preparing to buy. Either it won't create a desired type of screen display, or you don't have the right printer, or the chart you want is too large for your purpose, or one of a hundred other things. If a particular graphics function is important to you, do not trust to the opinions of the computer store's sales force (who haven't the vaguest idea how most of the software they sell works). If they can't or won't give you a demonstration of the precise functions you need using exactly the peripherals you have, then check, double-check and finally triple-check with the software's publisher. ◀●▶